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(71) Applicant(s)

Motorola Inc
(Incorporated in USA - Delaware)
1303 East Algonquin Road, Schaumburg,
Illinois 60196, United States of America

(72) Inventor(s)

Frederick Yi-Tung Cho

(74) Agent and/or Address for Service

Sarah Gibson
Motorola Limited, European Intellectual Property
Operation, Midpoint, Alencon Link, BASINGSTOKE,
Hampshire, RG21 7PL, United Kingdom

(54) Abstract Title

Tri-fold cellular telephone

(57) A tri-fold cellular telephone 100 includes a top housing portion 101, a center housing portion 102, and a bottom housing portion 103. Top housing portion 101 is rotatably coupled to center housing portion 102 via a first hinge 115. Bottom housing portion 103 is rotatably coupled to center housing portion 102 via a second hinge 116. Center housing portion 102 includes a display 105, a microphone opening with microphone positioned therebehind, and one or more retaining slots for attaching the auxiliary battery 108. Bottom housing portion 103 includes a keypad 107 that allows the user to power on and off the portable device 100 and initiate calls by inputting and sending digits of telephone numbers. Top housing portion 101 includes a recess for main battery 104 and a speaker bezel 106 having openings with a speaker positioned therebehind.

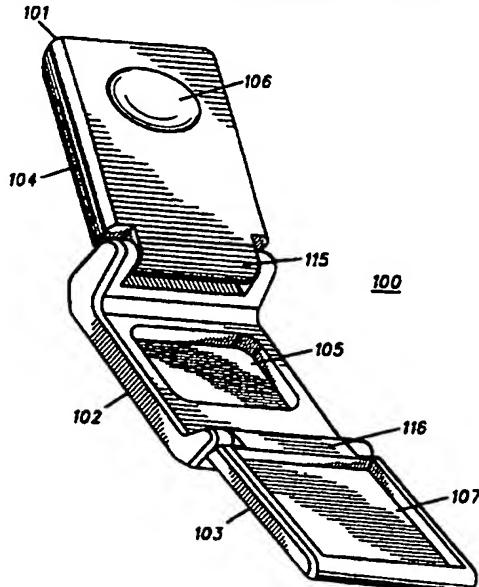
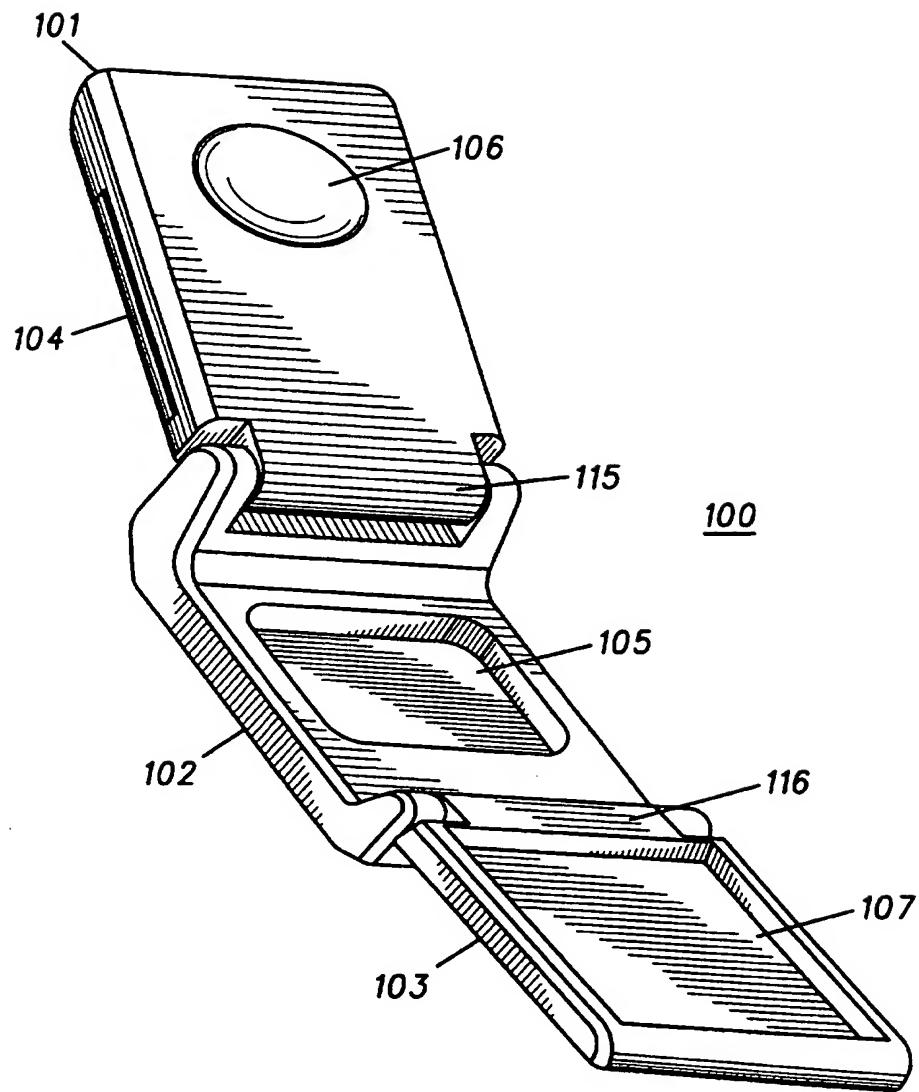


FIG. 1

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F I G . 1

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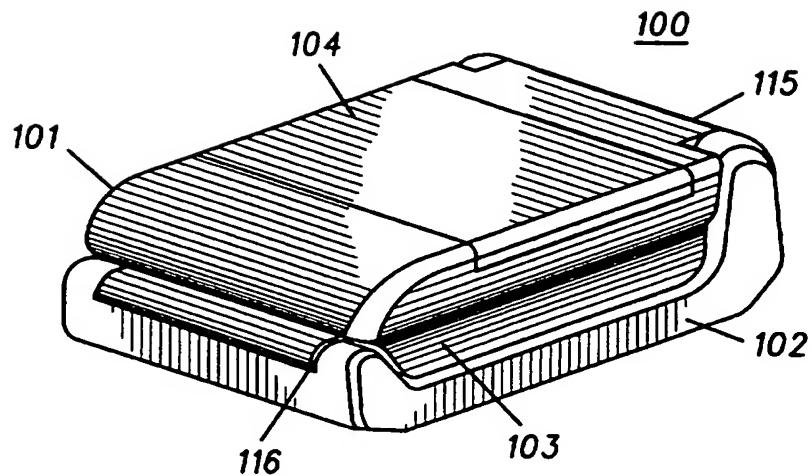


FIG. 2

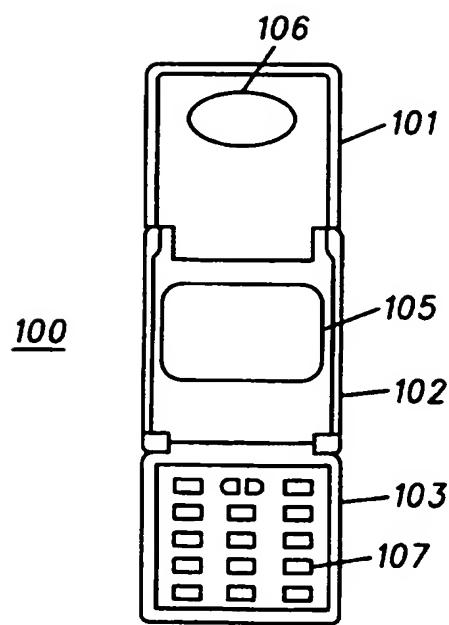


FIG. 3

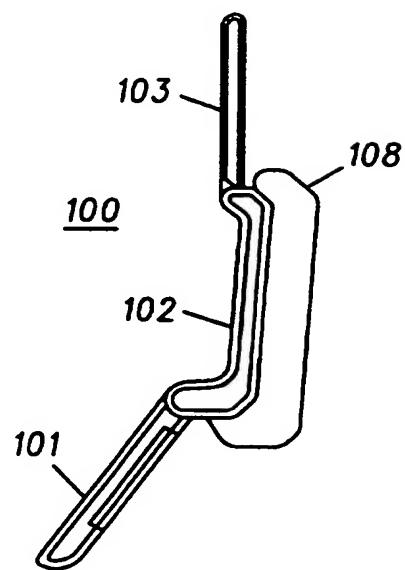


FIG. 4

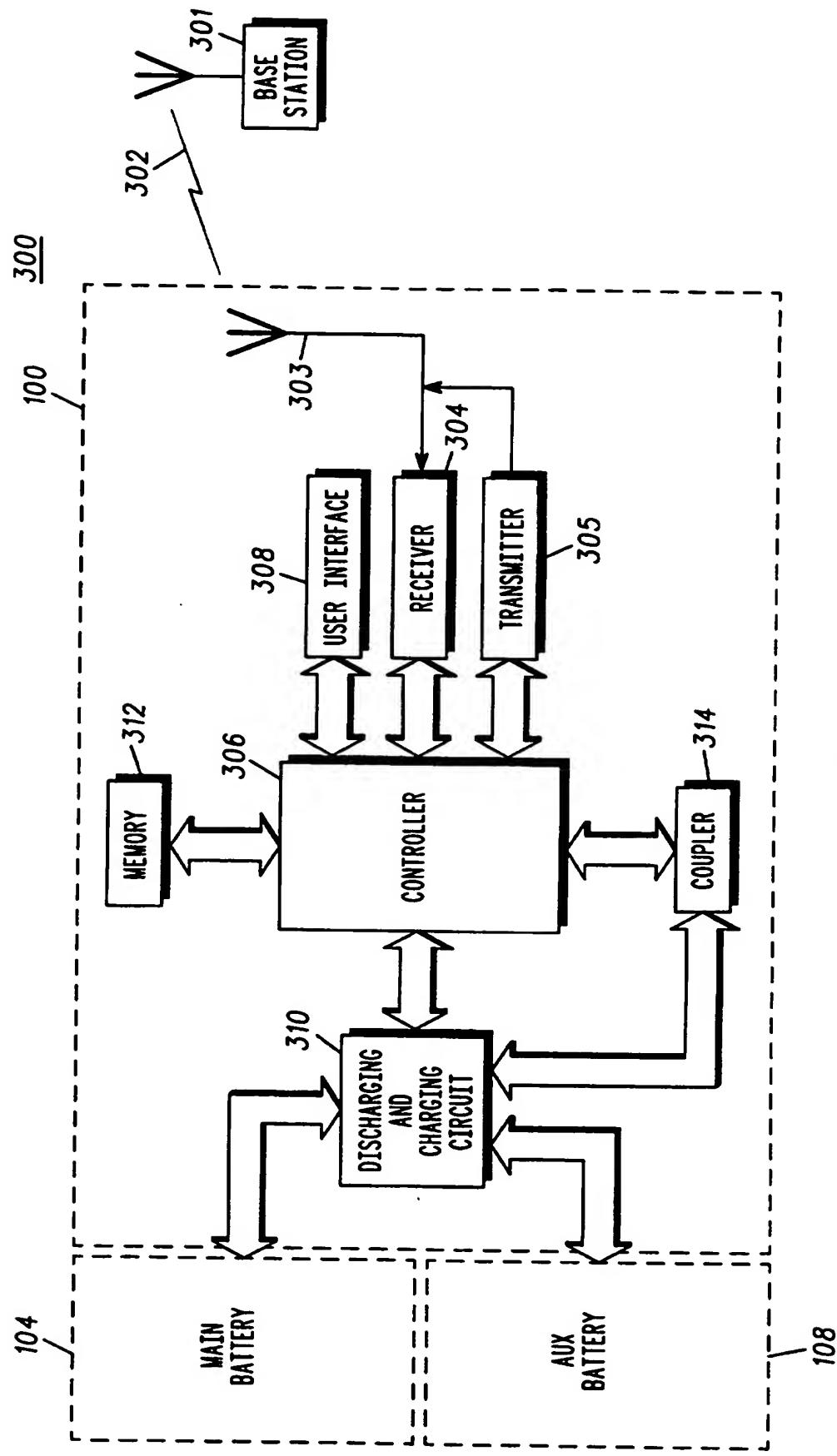
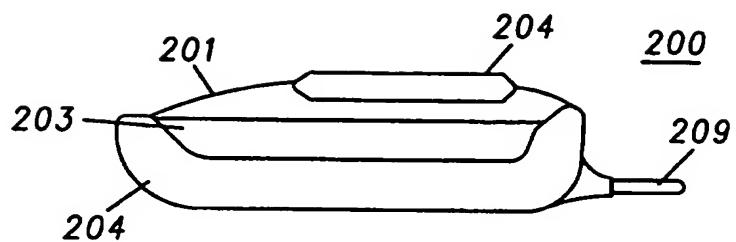
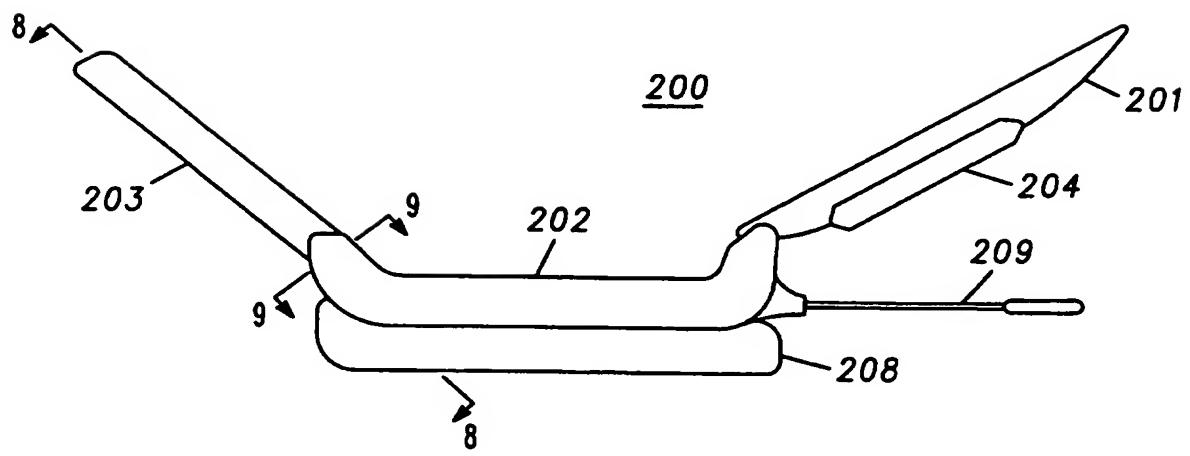


FIG. 5

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F I G . 6



F I G . 7

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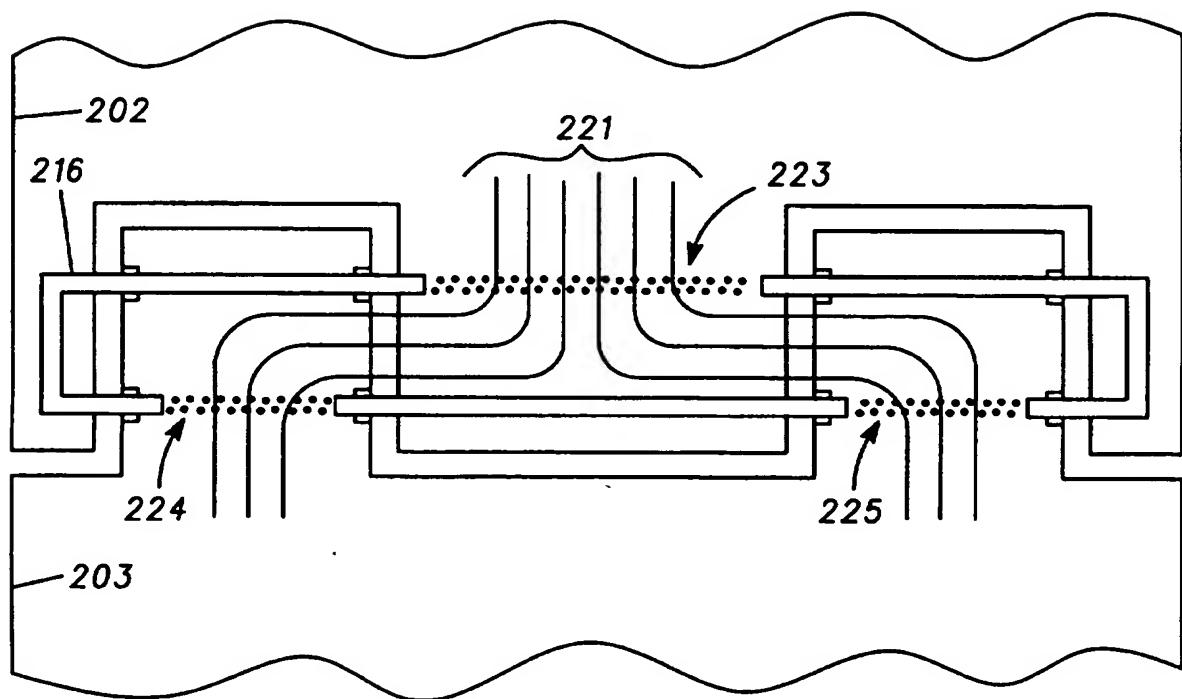


FIG. 8

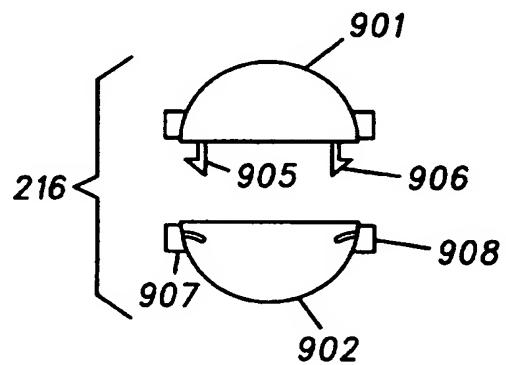


FIG. 9

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TRI-FOLD CELLULAR TELEPHONE

Background of the Invention

5 1. **Field of the Invention**

The present invention relates generally to radiotelephones, and more specifically to an improved tri-fold cellular telephone for use in cellular telephone systems.

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2. **Description of the Related Art**

Portable cellular telephones have become increasingly popular due to their light weight and compactness. In order to be user friendly, 15 it is important that the portable cellular telephones be as small as possible. The size has been reduced somewhat by using a foldable keypad cover such as the cellular telephones illustrated in US design patent nos. Des. 325,028, Des. 359,734, and Des. 369,598. Although these prior art cellular telephones have become smaller, it has been necessary 20 to retain substantially the same overall length in order to maintain the proper distance from the user's ear to mouth.

Accordingly, there is a need for an improved tri-fold cellular telephone which is smaller than prior art cellular telephones while maintaining the proper distance from the user's ear to mouth.

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Brief Description of the Drawings

FIG. 1 is a perspective view of a tri-fold cellular telephone shown in open position and embodying the present invention;

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FIG. 2 is a perspective view of the tri-fold cellular telephone of FIG. 1 shown in closed position;

FIG. 3 is a front elevation view of the tri-fold cellular telephone of FIG. 1;

5 FIG. 4 is a right side view of the tri-fold cellular telephone of FIG. 1;

10 FIG. 5 is an illustration in block diagram form of a radio frequency communications system employing the portable device of FIG. 1, the portable device having a discharging and charging circuit;

15 FIG. 6 is a side view of another embodiment of a tri-fold cellular telephone shown in open position and embodying the present invention;

20 FIG. 7 is a side view of the tri-fold cellular telephone of FIG. 6 shown in closed position;

FIG. 8 is a cross sectional view of the tri-fold cellular telephone of FIG. 7 taken along lines 8-8; and

20 FIG. 9 is a cross sectional view of the tri-fold cellular telephone of FIG. 7 taken along lines 9-9.

Detailed Description of the Preferred Embodiments

In FIGs. 1, 2, 3 and 4, the illustrated a tri-fold cellular telephone 100 with top, center and bottom housing portions 101, 102 and 103, which may be powered by main and/or auxiliary batteries 104, 108 in an operating state. Tri-fold cellular telephone 100 is preferably a portable handheld device that is small enough to be carried in a shirt pocket or in a clip attached to the user's belt or clothing. In FIGs 6 and 7, there is illustrated another embodiment of a tri-fold cellular telephone 200 with top, center and bottom housing portions 201, 202 and 203, which further includes a retractable antenna 209 shown in the retracted position in FIG. 6 and extended position in FIG. 7. In other embodiments, telephones 100 and 200 may be cordless telephones or multi-mode telephones. Moreover, the present invention is not limited to tri-fold structures and is intended to encompass four-fold and greater structures. In one embodiment of a four fold structure, an additional housing portion may be connected to top housing portion 101 in FIG. 1 and rotate counter-clockwise via hinge therebetween to close over top housing portion 101.

FIG. 1 illustrates a tri-fold cellular telephone 100 having a main battery 104. The tri-fold cellular telephone 100 includes a first or top housing portion 101, a second or center housing portion 102, and a third or bottom housing portion 103. Top housing portion 101 is rotatably coupled to center housing portion 102 via a first hinge 115. Bottom housing portion 103 is rotatably coupled to center housing portion 102 via a second hinge 116. Although top housing portion 101 is shown rotating clockwise to close, it may rotate counter-clockwise in other embodiments. Hinge 115 is offset from center housing portion 102 by substantially the thickness of bottom housing portion 203, such that top housing portion folds over and covers the closed bottom housing portion 203.

Center housing portion 102 includes control circuitry (see FIG. 5), a display 105, a microphone opening, and one or more retaining slots for attaching the auxiliary battery 108 (see FIG. 4). According to a feature

of the present invention, display 105 is recessed in the surface of center housing portion 102. An antenna (see FIG. 5) may be internal to center housing portion 102 or extend therefrom as shown in FIGs 6 and 7. A microphone (not shown) is positioned behind the microphone opening in center housing portion 102. The display 105 provides visual information to a user including, for example, telephone numbers, received signal strength, incoming caller name and phone numbers, and the current amount of charge remaining in the main battery 104 or the auxiliary battery 108.

Bottom housing portion 103 includes a keypad 107 (see FIG. 3) that allows the user to power on and off the portable device 100 and initiate calls by inputting and sending digits of telephone numbers. According to a feature of the present invention, bottom housing portion 103 rotates via a second hinge 116 to close over display 105 in center housing portion 102, thereby protecting display 105 from damage, dirt, dust, and other contamination.

Top housing portion 101 includes a recess for main battery 104 and a speaker bezel 106 having openings with a speaker (not shown) positioned therebehind. Main battery 104 produces a predetermined output voltage for powering tri-fold cellular telephone 100. Aside from providing speech to the user, the speaker or a separate transducer may provide an audible alert when an incoming call is being received and when the main and auxiliary batteries 104, 108 are near depletion. The main and auxiliary batteries 104, 108 are detachable from tri-fold cellular telephone 100.

FIG. 2 illustrates tri-fold cellular telephone 100 in a closed position. The main battery 104 inserts into a corresponding recess in top housing portion 101. The main battery 101 is attached to the tri-fold cellular telephone 100 by inserting it beneath a lip 218 in the surface of top housing portion 101 and rotating the main battery 104 downward into the recess. The main battery 104 is rotated until a latch member thereof engages corresponding members in the recess. The main battery 101 is detached by depressing the latch member away from the corresponding members in the recess and rotating the main battery 104

upward and out of the recess. The main battery 104 and corresponding recess in top housing portion 101 are described in more detail in the instant assignee's copending US patent application no. 08/558, 586, entitled "Apparatus and Method for Discharging and Charging a

5 Multiple Battery Arrangement", invented by Shakil H. Barkat, Matthew D. Mottier and Richard Ng, filed on October 31, 1995, and incorporated herein in it's entirety by reference thereto.

FIG. 5 is an illustration in block diagram form of a cellular telephone system 300 wherein a cellular base station 301 and the tri-fold cellular telephone 100 communicate via radio frequency (RF) signals 302. The tri-fold cellular telephone 100 includes an antenna 303, a receiver 304, a transmitter 305, a controller 306, and a user interface 308 that includes a speaker (not shown), the display 105 of FIG. 1, a microphone (not shown), and the keypad 107 of FIG. 1. The controller 306 could be, for example, a 68HC11 microprocessor available from Motorola, Inc. The integrated circuits of tri-fold cellular telephone 100 can be attached to light weight circuit boards of the type shown and described in US patent no. 5,301,420 (incorporated herein in it's entirety by reference) by means of direct chip attach or ball grid array technologies to reduce the circuit board thickness.

The tri-fold cellular telephone 100 is powered by the detachable main and auxiliary batteries 104, 108 and operates in the following manner. The antenna 303 transduces the RF signals 302 into electrical RF receive signals and couples the electrical RF receive signals to the receiver 304. The receiver 304 transforms the electrical RF receive signals into data receive signals that are then coupled through the controller 306 and output to the user as audible speech via the speaker and as operational information via the display 128. Speech and data input by the user via the microphone and the keypad 130, respectively, 25 are coupled to the transmitter 305 as data transmit signals. The transmitter 305 converts the data transmit signals into electrical RF transmit signals which are transduced by the antenna 303 and transmitted as the RF signals 302.

Originating/answering and terminating telephone calls with tri-fold cellular telephone 100 may be accomplished either by opening and closing top housing portion 101, or opening and closing, respectively, bottom housing portion 103. Controller 306 detects the opening and

5 closing of top housing portion 101 and bottom housing portion 103 and originates/answers a call being made/received or terminates a call in progress. Controller 303 may be implemented as shown and described in the instant assignee's US patent no. 4,845,772 incorporated herein in its entirety by reference thereto

10 The tri-fold cellular telephone 100 includes a discharging and charging circuit 310, a memory 312, and a coupler 314. The discharging and charging circuit 310 selectively discharges the main and auxiliary batteries 104, 108 to supply uninterrupted power to the portable device 100. The discharging and charging circuit 310 also selectively charges

15 the main and auxiliary batteries 104, 108 under the control of a program executed by the controller 306. The program is stored in the memory 312. The memory 312 is preferably a read-only memory (ROM), but could be an erasable programmable read-only memory (EPROM), a random-access memory (RAM), or other suitable memory. Although

20 the memory 312 is shown separate from the controller 306, it will be recognized that the memory 312 could be internal to the controller 306 and/or that the controller 306 may contain other memory in addition to memory 312. The coupler 314 permits a user to attach an external power supply (not shown) thereto for providing power to operate the

25 tri-fold cellular telephone 100 (and save battery charge) or charge the main and auxiliary batteries 104, 108. The operation and circuitry of discharging and charging circuit 310 are described in more detail in the instant assignee's aforementioned copending US patent application no. 08/558, 586, filed on October 31, 1995.

30 In FIGs. 6 and 7, there is illustrated a side view of another embodiment of a tri-fold cellular telephone 200 embodying the present invention and shown in open position in FIG. 6 and in closed position FIG. 7. Tri-fold cellular telephone 200 includes main battery 204 which protrudes slightly above the surface of top housing portion 201 and

provides room for larger and therefore higher capacity battery cells. Tri-fold cellular telephone 200 also includes a retractable antenna 209 shown in the retracted position in FIG. 6 and extended position in FIG. 7. An auxiliary battery 208 is shown in FIG. 7 attached to center

5 housing portion 202. Center housing portion 202 includes one or more retaining slots for attaching the auxiliary battery 108

In FIG. 8, there is illustrated a cross sectional view of tri-fold cellular telephone 200 of FIG. 7 taken along lines 8-8 which projects through the hinge 216. Hinge 216 carries wires 221 between center

10 housing portion 202 and bottom housing portion 203, where a portion of wires 221 entering opening 223 extend through to opening 224 and another portion of wires 221 entering opening 223 extend through to opening 225, to bottom housing portion 203 for interconnecting a controller in center housing portion 202 with a keypad in bottom

15 housing portion 203. Other ways to electrically interconnect center housing portion 202 with bottom housing portion 203 and/or top housing portion 201 are shown and described in the instant assignee's US patent no. 5,170,173 incorporated herein in it's entirety by reference thereto and in copending US patent application no. 08/437,344, entitled "Method and Apparatus for Routing Conductors Through a Hinge", invented by Scott D. Beutler and Brian J. Hassemer, filed on May 9, 1995, and incorporated herein in it's entirety by reference thereto.

In FIG. 9, there is illustrated a cross sectional view of the tri-fold cellular telephone of FIG. 7 taken along lines 9-9 and showing only top

25 member 901 and bottom member 902 of hinge 216. Top member 901 includes snaps 905 and 906 which couple with shaft locks 907 and 908, respectively, of bottom member 902. During assembly of hinge 216, wires 221 are positioned in openings 223, 224 and 225 and top member 221 is snapped to bottom member 902.

30 In summary, a unique tri-fold cellular telephone having detachable main and auxiliary batteries folds together such that the display is protected by the folded top and bottom portions. Since the top and bottom portions fold over the center portion, the tri-fold

cellular telephone can be small enough to fit in a user's shirt pocket or in a clip on the user's belt or clothing.

What is claimed is:

Claims

1. A radiotelephone, comprising:
 - a first housing portion;
- 5 a second housing portion having a first hinge and a second hinge, the first hinge for coupling the first housing portion, the second housing portion further including a display for displaying predetermined information;
 - a third housing portion having a predetermined thickness and being coupled to the second hinge of the second housing portion; and the first hinge of the second housing portion offset from the second hinge by at least the predetermined thickness of the third housing portion, said third housing portion rotating on the second hinge to fold over the display, and the first housing portion rotating on the first hinge to fold over the third housing portion.
- 10 2. A radiotelephone according to claim 1 wherein the third housing portion further includes a keypad to enter information and control the radiotelephone.
- 15 3. A radiotelephone according to claim 2 wherein the second housing portion includes a controller and the second hinge includes an opening for a plurality of wires to interconnect the keypad and the controller.
- 20 4. A radiotelephone according to claim 1 wherein first housing portion includes a compartment to retain a battery to produce a predetermined output voltage.
- 25 5. A radiotelephone according to claim 1 wherein the second hinge includes a top member and a bottom member, the top member including at least one snap and the bottom member including at least one shaft lock disposed opposite to the at least one snap, the at least one snap of the top member snapping into the at least one shaft lock of the bottom member during assembly.
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6. A radiotelephone according to claim 1 further including an antenna coupled to the second housing portion.
- 5 7. A radiotelephone according to claim 6 wherein the antenna is a retractable antenna having retracted position and an extended position.
8. A radiotelephone for originating and terminating telephone calls, comprising:
 - 10 a first housing portion;
 - a second housing portion having a first hinge and a second hinge, the first hinge for coupling the first housing portion, the second housing portion further including a display for displaying predetermined information;
 - 15 a third housing portion having a predetermined thickness and being coupled to the second hinge of the second housing portion; the first hinge of the second housing portion offset from the second hinge by at least the predetermine thickness of the third housing portion, said third housing portion rotating on the second hinge to fold over the display, and the first housing portion rotating on the first hinge to fold over the third housing portion: and
 - 20 a controller for detecting when the first housing portion is opened or closed and when the third housing portion is opened or closed to originate and terminate, respectively, telephone calls .
- 25



The
Patent
Office

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Application No: GB 9801260.2
Claims searched: 1 to 8

Examiner: Peter Easterfield
Date of search: 22 June 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4J (JK)

Int Cl (Ed.6): H04B 1/08, 1/38; H04M 1/02

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A, E	GB 2317531 A (NEC) see figs 7, 8 & 9	
X	US 5274613 A (SEAGER) see 32, 34, 36 in fig 3	1,8
A	WO 94/13088 A1 (MOTOROLA) see fig 1	

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.